UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

December 15, 2008

Colonel Dionysius Anninos, District Engineer
U.S. Army Corps of Engineers, Norfolk District
803 Front Street
Norfolk, Virginia 23510

RE: Draft Programmatic Environmental Impact Statement for Oyster Restoration in Chesapeake Bay Including the Use of a Native and/or Nonnative Oyster [CEQ # 20080414]

Dear Colonel Anninos:

In accordance with Section 102(2)(C) of the National Environmental Policy Act (NEPA), 42 U.S.C. § 4332(2)(C), Section 309 of the Clean Air Act, 42 U.S.C. § 7609, and the Council on Environmental Quality (CEQ) regulations, 40 CFR Parts 1500-1508, the United States Environmental Protection Agency (EPA) has reviewed the draft Programmatic Environmental Impact Statement (PEIS) for Oyster Restoration in the Chesapeake Bay, and offers the following comments.

EPA is serving as a cooperating agency and assisted in the development of the draft PEIS. As a cooperating agency, EPA provided technical assistance in the development of the Ecological Risk Assessment, served as a member of both the Project Delivery Team and Executive Committee, and provided technical and procedural recommendations throughout the EIS process. Our independent review authorities under Section 309 of the Clean Air Act require EPA to review and comment on all EISs. This review is distinct from our role as a cooperating agency, and is focused on environmental consequences of the proposed action and alternatives. In addition, EPA is the primary representative for the federal government for the Chesapeake Bay Program.

This draft PEIS evaluates the direct and indirect ecological, environmental, economic and human health effects of the proposed action and several alternatives to restore oysters in the Chesapeake Bay. The proposed action calls for introduction of a nonnative species, the Suminoe oyster (*Crassostrea ariakensis*) into the tidal waters of Maryland and Virginia, and a continuation of efforts to restore the native Eastern oyster *(Crassostrea virginica)* throughout the Chesapeake Bay, in order to restore the ecological role of oysters in the Bay and the economic benefits of a commercial fishery.

The draft PEIS was developed by the U.S. Army Corps of Engineers, Norfolk District as the lead federal Agency, and two non-Federal sponsors, the Maryland Department of Natural Resources and the Virginia Marine Resources Commission, who are serving as co-lead agencies for the project. The lead agencies are to be commended for their leadership in producing and presenting an extraordinary amount of technical information for public review and consideration.

The lead agencies provided open communication of the issues and facilitated interagency discussions throughout the development of the draft PEIS in a professional and collaborative manner. The readability of the document has improved dramatically in many respects when compared with earlier preliminary versions.

The stated purpose and need of the proposal is to:

- "restore the ecological role of oysters in the Chesapeake Bay and the economic benefits of a commercial fishery through native oyster restoration and/or the introduction of an ecologically compatible nonnative oyster species that would restore these lost functions" and

- "establish an oyster population that reaches a level of abundance in Chesapeake Bay that would support sustainable harvests comparable to harvest levels during the period 1920–1970."

In addition to the proposed action, which is to introduce the Suminoe oyster into the Chesapeake Bay and continue native oyster restoration activities, several alternatives were also evaluated in the draft PEIS. They are:

- Alternative 1: No Action - continue Maryland's present oyster restoration and repletion programs, and Virginia's oyster restoration program at current levels
- Alternative 2: Enhance Efforts to Restore the Native Oyster
- Alternative 3: Harvest Moratorium
- Alternative 4: Cultivate (Aquaculture) Eastern Oysters
- Alternative 5: Cultivate (Aquaculture) Nonnative Oysters
- Alternative 6: Introduce Another Nonnative Oyster Species
- Alternative 7: Introduce the Suminoe Oyster and Discontinue Efforts to Restore the Eastern Oyster
- Combination 8a – Use Eastern oyster only. Includes Alternatives 2, 3 and 4
- Combination 8b – Same as 8a, but with addition of Alternative 5, Aquaculture of sterile Suminoe oysters
- Combination 8c – The Proposed Action, plus Alternatives 2, 3, 4 and 5.

After due consideration, Alternatives 6 and 7 were eliminated from further study. No preferred alternative is identified in the draft PEIS in order to obtain the input of all interested stakeholders. In the absence of a preferred alternative being identified in a draft EIS, it is EPA practice to rate the environmental impacts of all alternatives.

EPA recognizes the complexity and implications of determining a strategy to restore an oyster population in the Chesapeake Bay to a level significantly greater than what currently exists. Before selecting a course of action for restoring oysters to the Chesapeake Bay, it is important to recognize that any option for increasing oyster abundance faces considerable challenges that will be overcome only through a broad set of policies and initiatives

implemented throughout the Chesapeake Bay watershed. Among these challenges are a severe decline in suitable hard bottom habitat from which to grow and support future populations, historic water quality changes in the Chesapeake Bay, particularly increased nutrients and sediments which can inhibit oyster restoration by smothering healthy reefs and making them unsuitable for future growth in a matter of a few years, the persistence of nonnative diseases affecting oysters in the Bay, and a high degree of uncertainty in predicting future results and effects.

Two main types of action alternatives were examined: those involving continued use of the native species, including aquaculture, and those involving employment of the nonnative Suminoe oyster. EPA recognizes that efforts to date to restore the native Eastern oyster have met with considerable disappointment. EPA has followed with interest the research that has been done on the possibility of introducing nonnative species, including the Suminoe oyster, into the Chesapeake Bay, and acknowledges that the intent of these efforts is to achieve a "second best" restoration of the Chesapeake Bay ecosystem by replacing the disease-susceptible native species with a hardier one. Such a step is likely to be irreversible, however, in two respects. First, the introduction of a species that competes directly with the Eastern oyster would likely make any recovery of the native species a permanent impossibility. Second, if the introduced species competes successfully, but has unanticipated harmful impacts on environment or human health, it is highly unlikely that it could later be removed from the Chesapeake Bay or other connected waters.

The Suminoe oyster appears to grow extremely quickly in the Chesapeake Bay. This fast-growing oyster could obtain a reproductive advantage over the Eastern oyster through the production of significantly greater numbers of gametes and offspring. As a result, the Suminoe oyster may have an advantage in interspecific competition, increasing the possibility that the Suminoe oyster would overwhelm the Eastern oyster in terms of population. EPA notes that this phenomenon appears to be occurring with the introduced Pacific oyster (*Crassostera gigas)* in New Zealand and Australia, where it is overwhelming native oyster species.

With regard to human health risks, EPA notes that the draft PEIS does not incorporate the findings of a recent study concluding that bioaccumulation of human pathogenic viruses in the Suminoe oyster may present human health concerns.[1] The study showed that the Suminoe oyster is not only more likely to harbor viruses, but, if exposed to contaminated water, it may accumulate and retain multiple virus types. The study also showed that the Suminoe oyster can tolerate a wider range of salinities and retain pathogens for significantly longer time periods than the Eastern oyster. This raises the question of whether the introduction of the Suminoe oyster into the Chesapeake Bay may present elevated public health risk for consumers.

In addition, EPA is concerned that introduction of the Suminoe oyster may not be consistent with the "Chesapeake Bay Policy for the Introduction of Non-Indigenous Aquatic Species." While the Corps of Engineers was not involved in the development of this policy, it was signed by the EPA Administrator and the Governors of Maryland and Virginia, along with

---

[1] Nappier, Sharon P., Graczyk, Thaddeus K., Schwab, Kellogg J., **Bioaccumulation, Retention, and Depuration of Enteric Viruses by *Crassostrea virginica* and *Crassostrea ariakensis* Oysters,** Appl. Environ. Microbiol. 2008 0: AEM.01000-08

the other Chesapeake Bay Program Executive Council members. The intent of the policy is to protect the Chesapeake Bay ecosystem from the adverse impacts of invasive non-indigenous species. The policy established a precautionary approach to proposed nonnative introductions, that is, a nonnative species should not be introduced unless and until sufficient studies have been conducted and evaluated to ensure that the risks associated with the proposed introduction are acceptably low. A related Chesapeake Bay Program policy contained in the Fisheries Management Plan places the burden of proof on the proponent to demonstrate that a proposed action will not harm the Chesapeake Bay ecosystem.

For these reasons, EPA believes that introduction of nonnative oysters into the Chesapeake Bay should only be contemplated on the basis of persuasive scientific information indicating that (1) there is little likelihood that the Eastern oyster will make a successful recovery, and (2) the introduced species will not have adverse consequences for human health or for the Bay ecosystem as a whole. While the draft PEIS is a thorough and comprehensive review of the available scientific information, EPA's view is that the state of the science does not yet support a decision to introduce nonnative species.

On this basis, and as supported by our technical comments (Enclosure 1), EPA has rated the Proposed Action and Alternatives 5, 8b and 8c "Environmentally Unsatisfactory" (EU) in accordance with EPA's national rating system (Enclosure 2). EPA has rated Alternatives 4 and 8a as "Environmental Concerns" (EC), based on direct and indirect effects of new infrastructure that would be needed to support an expansion of the aquaculture industry for native oysters. EPA rated Alternative 1 as "Lack of Objections" (LO) due to the minimal environmental impacts of continued native oyster restoration activities. EPA notes, however, that it remains deeply concerned about the *status quo* condition of the Chesapeake Bay, and is committed to working with its Federal, State, Tribal, and local partners to explore all options to restore the Chesapeake Bay's ecological health. EPA has also rated Alternatives 2 and 3 LO.

With regard to the adequacy of the document, EPA has assigned a rating of "Insufficient Information" (2), specifically because of concerns about the lack of information on the biology and ecology of the nonnative oyster. EPA notes, however, that although there is a lack of information regarding these issues, the data that are presented represent the most recently available scientific information. EPA would like to continue to work with you to discuss what additional analyses should be included in the final PEIS to improve the reliability of the predicted impacts of the proposed action and the alternatives.

EPA also suggests that Alternative 8a may be the optimal approach to restoring oysters in the Chesapeake Bay and is our preferred alternative. The native oyster, although stressed by anthropogenic activities such as overfishing and loss of habitat due to harvest methods and sedimentation, represents a practicable and lower risk, precautionary approach to restoring oysters to the Chesapeake Bay. Habitat and other ecological needs and impacts of the native oyster are more fully documented than for nonnative oysters. If healthy, the native oyster can provide all of the ecological functions of a sustainable oyster population and has historically proven to support a viable fishery. Moreover, EPA is encouraged by recent demonstrations of progress in native oyster restoration efforts and the evolution of natural disease resistance in oyster populations in a number of Chesapeake Bay locations, including the Rappahannock,

Great Wicomico, and Lynnhaven Rivers and Tangier Sound.[2] With a refocusing of efforts on restoring the ecological components of the native oyster, EPA believes that a viable fishery, with controlled harvest, can be achieved. EPA would also recommend that any continuation of a wild or hatchery-supported fishery be based on reliable stock monitoring and sustainable harvest principles (e.g., the Total Allowable Catch system employed in Delaware Bay). Finally, EPA also recommends, as others have, that a Bi-State Commission be formed to coordinate both research and restoration efforts of native oysters in the Chesapeake Bay.

Thank you for the opportunity to provide these comments, and to participate in the Oyster Restoration PEIS as a cooperating agency. Please be assured that while EPA is not presumptively opposed to the introduction of the Suminoe oyster to the Chesapeake Bay, EPA believes more work is necessary before such a critical decision is made. EPA remains committed to continuing its support of restoring both the ecological and economic benefits of a viable oyster population in the Chesapeake Bay. If you have questions regarding these comments, please contact Mr. William Arguto, who can be reached at 215-814-3367.

Sincerely,

for Donald S. Welsh
Regional Administrator

Enclosures
Supporting Technical Comments
EPA EIS Rating System

cc: John R. Griffin, Maryland Department of Natural Resources
L. Preston Bryant, Jr., Virginia Secretary of Natural Resources
Marvin E. Moriarty, U.S. Fish and Wildlife Service
Peyton Robertson, NOAA Chesapeake Bay Field Office
John V. O'Shea, Atlantic States Marine Fisheries Commission

[2] US Army Corps of Engineers Norfolk District native oyster restoration; pers. Communication

ENCLOSURE 1 - Supporting Technical Comments

Draft Programmatic EIS - Oyster Restoration in the Chesapeake Bay Including the Use of a Native and/or Nonnative Oyster, Chesapeake Bay, Maryland and Virginia. [CEQ Number 20080414].

Irreversible and Widespread Consequences

Adverse effects from the introduction of a nonnative oyster would be irreversible and could not be mitigated. A consensus of scientists involved in the research of using nonnative oysters agrees that introducing a nonnative oyster would be irreversible. [1] This conclusion was also reiterated by the Oyster Advisory Panel that provided an independent peer review of the draft PEIS [2]. EPA believes that the introduction of the Suminoe oyster to the Chesapeake Bay would be irreversible and that, once introduced, the nonnative oyster likely would spread to other estuaries outside the Chesapeake Bay, perhaps in the same ecological range of the native oyster (See figure 3-8 draft PEIS). These factors would make any mitigation for unintended consequences impracticable.

Human Health

The draft PEIS does not incorporate the findings of a recent study of the bioaccumulation of human pathogenic viruses in the Eastern oyster and the Suminoe oyster that may indicate human health concerns with the introduction of the Suminoe oyster.[3] The study showed that the Suminoe oyster is not only more likely to harbor viruses, but, if exposed to contaminated water, it may accumulate and retain multiple virus types. Because the study also showed that the Suminoe oyster can tolerate a wider range of salinities and retain pathogens for significantly longer time periods than the Eastern oyster, the introduction of the nonnative Suminoe oyster into the Chesapeake Bay appears to present elevated public health risk for consumers.

Biodiversity Loss

The potential introduction of the Suminoe oyster raises concerns over impacts to biodiversity. If the nonnative oyster becomes invasive, the unintended consequences of the introduction may have effects that have been witnessed with other invasive species. A major effect of human-driven invasive species introductions is a loss of biodiversity. About 400 of the 958 species that are listed as threatened or endangered under the Endangered Species Act are considered to be at risk primarily because of competition with and predation by non-indigenous species [4] It is estimated that exotic species have contributed to 40% of species extinctions in the United States[5] (Pimentel 2003). Invasive species are the second most important threat to native species, behind habitat destruction [6](Stein and Flack 1996).

Uncertainty

The draft PEIS appropriately acknowledges the high degree of uncertainty in projections of demographic and ecological outcomes from the proposed action and other alternatives that would involve the use of nonnative oysters. The draft PEIS recognizes a wide range of possible outcomes and a long list of factors that could contribute to outcomes at one end of the range or the other (e.g., if it were intentionally introduced or escaped and established, the Suminoe oyster might become so abundant as to cause costly fouling problems, or, conversely, it might entirely fail to establish in the wild due to its vulnerability to predation and disease).

The oyster demographic modeling presented in the draft PEIS and the further analyses that are dependent upon that modeling are of little value to the analysis of likely environmental impacts. Key information that would be necessary to use demographic modeling to reliably project oyster demographic and ecological outcomes is not available (e.g., reliable estimates of historic and current native oyster stocks, current fishing mortality rates, etc.) Unless and until these data deficiencies are remedied, further study and evaluation are not likely to significantly improve the ability to predict environmental impacts in the near term.

The draft PEIS compared the alternatives considered by developing implementation plans for each. The implementation plans were used to project whether each alternative could meet the goal of restoring oysters to sustainable levels that were defined in the draft PEIS. The draft PEIS accurately states that the level of uncertainty for nearly all of these projections is extremely high. To add to the uncertainty, the draft PEIS uses a 10 year horizon as a bound to assess the effects of each alternative on the predicted oyster population response. It is understood why a bound is needed to frame the discussion in assessing how each alternative meets the intended objectives of the draft PEIS. However, we recommend that the final PEIS present, at a minimum, qualitative information that addresses periods greater than 10 years, and the possible response of the oyster population to the alternatives.

In addition, the draft PEIS acknowledges the inability of scientists to model the population growth of the Suminoe oyster. Without an ability to predict the population growth of the introduced species, we have significant concerns over the reliability of draft PEIS's conclusions. Given the high level of uncertainty in predicting the outcome of any of the alternatives, we recommend considering a risk-averse precautionary approach with respect to the introduction of a nonnative species. Such an approach would avoid the unpredictable adverse ecological risks associated with nonnative oysters, and would point towards the selection of a native oyster alternative that, with greater certainty, carries lower ecological risk.

Purpose and Need

Several scientists and scientific committees, including the Oyster Advisory Panel, have recommended splitting the purpose and need statement into two separate parts: First, what is the best alternative for commercial oyster aquaculture? Second, what is the best alternative for restoring oysters as an ecological component in the Chesapeake Bay? EPA does not believe that the two goals are mutually exclusive. However, we believe that none of the alternatives

presented in the draft PEIS are capable of meeting the stated purpose, i.e., reaching a level of oyster abundance within a 10 year planning horizon supporting harvests comparable to the period 1920-1970. In addition, we also recognize that different alternatives may achieve each purpose to a greater or lesser degree, e.g., aquaculture can achieve some economic gains through an enhanced fishery, but provides limited widespread ecological benefits. EPA recommends that the purpose and need statement be modified as described above to contain two parts reflecting more modest incremental goals that are realistically achievable.

Habitat Loss and Sedimentation

One of the fundamental issues highlighted throughout the draft PEIS is the loss of oyster habitat due to sedimentation and its effects on restoring oyster populations in the Chesapeake Bay. Sedimentation and the resultant habitat loss are contributors to the oyster population decline and will continue to decimate the oyster population regardless of which alternative is selected. By not focusing on these issues, the draft PEIS may have overemphasized the role of Dermo and MSX and potentially created a bias in favor of the Suminoe oyster introduction. EPA recommends that the final PEIS provide additional consideration of the roles of stressors such as sedimentation and habitat loss in any restoration effort.

Demographic modeling

The oyster demographic model presented in the draft PEIS is a commendable attempt at a process-oriented simulation of the population. However, a significant concern is with the modeling of recruitment. Modeling this process from adult fecundity through larval transport, spat density, growth, and mortality is likely to result in large errors which cannot be estimated reliably. Empirical studies have not shown significant systematic relationships between spat settlement densities as measured by surveys and subsequent recruitment to the market stock, or indeed, any coherent stock-recruitment relationship. The model description does not contain enough information to fully evaluate how this process was modeled, or what lines of verification were employed.

If the model significantly overestimates recruitment, as suspected, then that would account for the insensitivity of the model to fishing mortality, as evaluated for Alternative 3. In considering this question, EPA revisited the previous demographic model of the Maryland oyster population (Jordan and Coakley 2004[7]) and found this model a sound competitor with the Vølstad et al. model for simulating restoration scenarios. The Jordan Coakley publication noted several lines of verification, including accurate hindcasts of stock and harvest. Although the Jordan Coakley model was crude relative to the Vølstad et al. model, it was strongly rooted in time series data and introduced fewer uncertainties. In retrospect, the Jordan Coakley model could have generated more conservative results by varying carrying capacity and exploring sensitivity to this parameter. On this particular point, the Vølstad et al. model is superior because of their better-informed use of habitat information.

Finally, there is a serious error in the discussion of model natural mortality (Volume 1, pages 4-28 and 4-29; Appendix A, page 4-13). The assertion that Jordan and Coakley (2004) used

mortality estimates from the wrong years in their model is incorrect. A careful reading of the publication shows that it used the correct data, even though Table 1 could be misinterpreted. The mortality rates listed in Table 1 of Jordan and Coakley (2004) are for "harvest years," i.e., the years when the oyster season closed. These rates were correctly obtained from the previous year's fall oyster surveys, that is, the mortality rates shown for harvest year 1986 were obtained from the 1985 fall survey. This matter was addressed carefully in a review of the Vølstad et al. manuscript, yet the misinformation remains. Moreover, to assert in the PEIS that this issue "invalidate[s] their conclusions" (Vol. 1, page 4-29) is erroneous. These statements should be corrected in the final PEIS.

Additional Detailed Comments

Section ES Abstract Page ES-1. Please add more information on how the PEIS will be used in potential next steps of this process. Will additional analysis be required at a site-specific level? Will permits be required?

Section E.2, Page ES-3. The paragraph which begins "During the mid-20th century, . . . " understates the high uncertainty associated with estimates of recent status and trends in native oysters. EPA recommends that the paragraph be revised to acknowledge that the unavailability of any reliable bay-wide oyster stock assessments (see footnote 3, page 1-9) does not allow reliable quantification of current oyster stocks or current trends in oyster populations. Specifically, there is no reliable evidence that the "steep decline continues to the present." (Revise also Section 1.1.1, page 1-1)

The same paragraph (and Section 1.2, page 1-9) also inaccurately states that "the Eastern oyster had no resistance" to MSX and Dermo. Apparently there is natural disease resistance in the native oyster population, as recently observed in mature oysters in the Rappahannock, Lynnhaven, and Great Wicomico Rivers[8]. Failure to recognize the native oyster's capacity to resist disease in this manner introduces a bias against native oyster alternatives evaluated in the document.

EPA also recommends that the same paragraph be revised to acknowledge that, even as "During the mid-20th century, oyster harvests remained comparatively stable for several decades", that fact says nothing about the contemporary trend in oyster populations. It is quite plausible that stable harvests for those several decades continued to deplete the standing stock and degrade reef habitats. Without reliable stock assessment data, the actual relationship between harvests and stocks during that period is unknown, so the cause of the present low levels of oyster stocks cannot be retrospectively determined with reasonable confidence. Overharvest, however, likely played a significant role. (Revise also Section 1.1.2, page 1-3)

Section E.2 Pages ES-3. In the second sentence reference is made to the decline of the oyster population due to MSX and Dermo. It would be appropriate to add how these diseases were introduced to the Chesapeake Bay.

Section E.2 Page ES-3. Also in the second paragraph mention is made of how the overall populations are controlled by disease. "Overall, oyster populations in the Bay are now strongly controlled by disease pressure (Ford and Tripp 1996) as well as the continuing loss of hard bottom and oyster shell essential for their successful reproduction. Harvest, various kinds of degradation of oyster habitat, poor water quality, and complex interactions among these factors are also negatively affecting oysters." Is there additional information that indicates which of the stressors, disease, habitat loss, etc. is the most significant contribution to the oyster population decline?

Section E.2, Page ES-4, the paragraph that begins "USACE, VMRC, and DNR all have been conducting extensive programs." significantly overstates the scope and intensity of oyster restoration efforts in the Chesapeake Bay and is therefore inconsistent with Section 1.3.4 in that regard. Oyster restoration efforts in the Chesapeake Bay have been severely limited by a number of factors, have been far from extensive, and would be more appropriately characterized as experimental or pilot. Major limits on the extent of oyster restoration have included limited government funding, limited supply of hard substrate with which to restore reef structures, limited hatchery capacity and hatchery performance, limited access to optimal reef habitats for restoration, lack of a reliable stock assessment or useful population model to assess harvest impacts, and, probably, poaching of oysters from restoration sites. Not recognizing these limitations introduces a bias against native oyster restoration alternatives in the document.

Section E.4.3, Page ES-7, the second paragraph in this section oversimplifies the issue of the use of disease-resistant native oyster strains to restore wild oyster populations. While highly inbred laboratory stocks do pose the risk of genetic bottlenecks, recent discovery of natural disease resistance in wild stocks provides the opportunity to rotate wild, disease resistant individuals into hatcheries on a temporary basis for breeding, then replacing them with other wild disease resistant individuals in order to avoid the genetic bottlenecking effect. Not recognizing this option introduces a bias against native oyster restoration alternatives in the document. (Revise also Section 2.2.2)

Section E.4.3 page ES-7. It may be helpful to add the definition of repletion and restoration to the glossary.

Section E.4.6, Page ES-8, the third paragraph in this section understates the probability that a large-scale aquaculture operation using triploid Suminoe oyster could result in an unintended introduction of a reproducing population of the species. The National Research Council recognized that "Over the long term it is likely the some nonnative oyster larvae will be spawned; whether the larvae will survive, establish a nonnative population, and spread throughout the bay is unknown. The potential number of larvae released is directly related to the scale of triploid aquaculture. Under Option 2 [sterile triploid aquaculture] dramatic expansion of aquaculture effectively grades into a small-scale diploid introduction as described for Option 3 [direct introduction of reproductive Suminoe oysters]."[9] (NRC, p. 235) In our view, such an unintended introduction would be practically inevitable.

Section E.6, Pages ES 10 – 19, (and Section 1.1.3, page 1-5) EPA is concerned that introduction of the Suminoe oyster may not be consistent with the "Chesapeake Bay Policy for the

Introduction of Non-Indigenous Aquatic Species does not recognize the Chesapeake Bay Program's "1993 Policy for the Introduction of Non-Indigenous Aquatic Species", which was signed by the EPA Administrator, and by the Governors of Maryland and Virginia, along with the other Chesapeake Bay Program Executive Council members. This policy establishes a precautionary "clean list" approach, which puts the burden of proof on introduction proponents to show with scientific evidence that the risks associated with the introduction would be acceptably low. The National Research Council recognized the value of this policy for the question of nonnative oyster introduction in the Bay. EPA recommends that Section E.6 be revised to recognize the 1993 CBP policy, which is:

> *"It shall be the policy of the Jurisdictions in the Chesapeake Bay basin to oppose the first-time introduction of any non-indigenous aquatic species into the unconfined waters of the Chesapeake Bay and its tributaries for any reason unless environmental and economic evaluations are conducted and reviewed in order to ensure that the risks associated with the first-time introduction are acceptably low. The signatories to the Adoption Statement are committed to sharing information and to carefully assessing through a joint review process all proposed first-time introductions of non-indigenous aquatic species in the Chesapeake Bay basin. The signatories to the Adoption Statement are also committed to working together to prevent unintentional introductions of non-indigenous aquatic species and to minimize the negative effects of undesired aquatic species within the Chesapeake Bay ecosystem." (Chesapeake Executive Council, 1993)*

We also recommend that Section 5.1 acknowledge the consultation requirements under this policy, and be modified to also recognize the Chesapeake Bay Program commitment to adhere to a precautionary approach as recommended in the "Fisheries Ecosystem Plan for Chesapeake Bay", which was adopted by the Chesapeake Executive Council in November 2005 (FEP, p. 6). Central to the precautionary approach described in the FEP is the placement of the burden of proof on decision makers "to show that the proposed change will not harm the ecosystem or fishery under management." (FEP, p. 228)

Table ES-1. EPA recommends that the Summary Table indicate the degree of uncertainty associated with the predictions uniformly across the "affected environment" rows. This was important information that was part of draft versions of this table and provided the reader with a level of confidence in the stated predictions.

Page 1-2. Reference is made to "participating agencies". Who are the participating agencies in this context and how will they participate in selecting a preferred alternative?

Page 1-8 second paragraph. The last sentence of this paragraph mentions that the draft PEIS will provide information to assist resource agencies to determine if the Suminoe Oyster is invasive. EPA suggests that this determination be made for any alternative using the Suminoe Oyster before it is selected in a record of decision.

We recommend that Section 1.3.5 be revised to indicate that the oyster biomass estimates in Figure 1-3 have no associated error bands (confidence intervals), and therefore there is

insufficient information to conclude with confidence that the oyster population in the Chesapeake Bay differed significantly from year to year. Thus, the data provide insufficient evidence to reject the hypothesis that the biomass of oysters in the Chesapeake Bay has remained the same over the period of analysis. The conclusion in this section (page 1-19) that "a general downward trend in oyster abundance over the most recent decade is apparent" is not substantiated by the data and we recommend that it be revised accordingly.

Section 1.3 Page 1-12. How do the goals established in the Chesapeake 2000[10] agreement compare to the goals and objectives established in the draft PEIS? It may be appropriate to add this information to give the reader a sense of scope by comparing this draft PEIS to other restoration efforts.

Section 1.3 Page 1-13. In the second paragraph please provide information, if available, explaining why the shell dredging program ceased in 2006.

Section 1.4 recognizes the research recommendations provided by the National Research Council (NRC). In addition to research recommendations, the NRC also listed and explained several "myths" associated with the oyster restoration challenge in Chesapeake Bay. EPA recommends that the NRC's discussion of these myths be incorporated in this section with a summary analysis of their potential relevance to the consideration of the alternatives evaluated in the draft PEIS.

Section 2.1.1 Page 2-1. The draft PEIS describes the uncertainty in estimating the benchmark population described in the purpose and need that was used to compare alternatives. This was also highlighted in the Oyster Advisory Panel comments. This adds to the uncertainty especially toward measuring the success of the alternatives compared to the benchmark.

Section 2.2.2 Alternative 2 is defined as enhanced efforts to restore the native oyster and is described as expanding, improving and accelerating oyster restoration and repletion. Past efforts to expand and accelerate restoration are described in this section, but there is very little discussion of methods to accelerate and improve native restoration efforts. This makes comparison of the alternatives difficult. The predicted outcomes of this alternative are based on results of past efforts that do not account for any acceleration or improvements. EPA recognizes that perhaps there are no known new approaches beyond those described to enhance and accelerate restoration. EPA suggests that a bi-State Oyster steering commission be established to manage restoration issues, as well as fisheries management issues. This recommendation has also been offered through the Oyster Advisory Panel.

EPA recommends that Sections 2.2.4 and 2.2.5, and the analysis of Alternative 4: Cultivate Eastern Oysters and Alternative 5: Cultivate a Nonnative Oyster, as well as subsequent combinations of alternatives containing these alternatives, be revised to eliminate the economic feasibility constraint on these alternatives. Any consideration of economic feasibility should be included in the discussion of all alternatives or none of the alternatives, aquaculture alternatives are the only ones so constrained,

EPA recommends that Section 2.2.5, page 2-9 be revised to remove the sentence "Genetically

altered triploid oysters generally are almost completely sterile and, therefore, are believed to be unlikely to contribute to an accidental introduction." There are many scientists, including the National Research Council Committee, who disagree with that statement. The National Research Council Committee recognized that "Over the long term it is likely the some nonnative oyster larvae will be spawned; whether the larvae will survive, establish a nonnative population, and spread throughout the bay is unknown. The potential number of larvae released is directly related to the scale of triploid aquaculture. Under Option 2 [sterile triploid aquaculture] dramatic expansion of aquaculture effectively grades into a small-scale diploid introduction as described for Option 3 [direct introduction of reproductive Suminoe oysters]." (NRC, p. 235) In our view, such an unintended introduction would be practically inevitable. [11]

EPA recommends that Section 3.2 be revised to include a separate subsection titled "Biological Integrity." The new subsection would include the following conventional definition of biological integrity: "Biological integrity is defined as the ability to support and maintain a balanced, integrated, adaptive biological system having the full range of parts (genes, species, assemblages) and processes (mutation, demography, biotic interactions, nutrient and energy dynamics and metapopulation processes) expected in the natural habitat of a region." (Karr, 1996) Also, a new subsection in section 4 would evaluate the risks and consequences of all the alternatives with respect to biological integrity, including the fact that the introduction of a nonnative oyster would compromise the biological integrity of the Chesapeake Bay, at a minimum, by changing the natural assemblage of species.

Section 3.5 Page 3-27. Please add information to indicate what section provides the conclusions to the EFH assessment.

Section 3.6 page 3-39. An explanation and a description of the differences in public grounds and private leases would be helpful.

Section 3.8.3 page 3-47. Please provide examples of significant indirect effects identified in the second paragraph.

Section 3.13 page 3-59. EPA recommends adding a section titled human health concerns and separating the issues of public safety and fouling from the human health issues. As mentioned in the previous comments regarding human health concerns, this issue could be significant and should be addressed separately.

Section 4.1.1.1 page 4-8. Please indicate which species was studied (Breese and Malouf).

Section 4.1.1.2 page 4-13. Given the many factors that could influence spawning success, it is not possible to predict how these interactions would affect the population of either species over time, or the extent to which this phenomenon could constrain the rate of growth of an introduced population of the Suminoe oyster.

Section 4.1.3 page 4-22. In the discussion of the enhanced restoration alternative, the draft PEIS provides information regarding discussions of developing a disease resistant native oyster. This

recommendation was rejected based on a workshop held in 2007 that concluded that, using a precautionary approach, the workshop participants would not recommend using artificially selected strains of native oysters (PEIS page 4-22). EPA agrees with this approach and recommends that it be applied throughout this study and in any record of decision. EPA recommends further evaluation of the potential use of wild disease-resistant stocks in hatchery production on a rotating basis as a possible resource of naturally evolved disease resistance.

Section 4.1.3 page 4-23. In the second paragraph, EPA recommends including the total loss of habitat projected to occur over this same time period due to sedimentation.

Section 4.1.3 page 4-24. The draft PEIS states "Any increase in the Bay-wide oyster population that might result from Alternative 2 would occur in oligohaline waters in Maryland and would not be self sustaining. Neither form of Alternative 2 would be likely to achieve the restoration goal for this PEIS." Please provide additional discussion of why, if this is pursued, it will not meet the restoration goal.

Section 4.1.4 page 4-28. The draft PEIS states "Lack of accurate quantification of historical and current exploitation rates for oysters in Chesapeake Bay is a major constraint on predicting the response of the Bay-wide oyster population to a harvest moratorium." Does the lack of accurate quantification also affect the total number of oysters estimated for a sustainable population?

Section 4.1.6.1 page 4-41. Please add or refer to the bio-security costs for nonnative oysters; we recommend referring to the Virginia Seafood Council trials to gather this information.

Section 4.1.6.2 page 4-49. The draft PEIS understates the risk of an unintended introduction of a nonnative oyster for alternative 5. See comments on this issue presented above.

Section 4.2. The second paragraph statement "the key ecological risk of the proposed action and all the alternatives is the risk of failing to restore the Bay-wide population of oysters to the historic reference level" is confusing and we recommend that it be revised. As written, the statement appears to attempt to simplify the ecological risk question and justify a course of action to increase oyster biomass at any cost to the Chesapeake Bay. EPA disagrees with any such argument and favor instead a careful consideration of the full range of potential ecological impacts that introduction of a nonnative oyster might cause.

Section 4 should be revised to address more thoroughly the human health risks associated with the Suminoe oyster's tendency to bioaccumulate and retain enteric viruses at rates far in excess of native oysters. See, Nappier, Sharon P.; T.K. Graczyk; and K.J. Schwab. 2008. Bioaccumulation, Retention, and Depuration of Enteric Viruses by Crassostrea virginica and Crassostrea ariakensis Oysters. Applied and Environmental Microbiology, 74(22).

Section 4.3.1 page 4-74. Please add the level of uncertainty in concluding "If the introduction were successful, a greater than 10-fold increase in oyster biomass could be a reasonable expectation.." EPA recommends that the level of uncertainty associated with the conclusion be stated with any conclusion presented.

Section 4.3.7 page 4-76. Please add the level of uncertainty to the combination 8c alternative. Although it has the highest potential, how uncertain is the outcome?

Section 4.6.1.7 page 4-112. The first paragraph on this page provides speculation on stakeholders' support of alternatives. As suggested in this paragraph, it should be revised in the final PEIS based on the results of public meetings and response to the draft PEIS. We also recommend that the paragraph clarify that even with these changes, the PEIS this might not represent all views.

Section 4.6.2 page 123. The analysis of the economic considerations of bio-secure hatcheries is an important factor in comparing alternatives and we recommend that it be added to this section.

Section 4.11 Environmental Justice – EPA has concerns about the environmental justice assessment conducted for this proposed action and its alternatives. From the draft PEIS, EPA is unable to ascertain whether appropriate outreach and community involvement activities were conducted to ensure the meaningful involvement of low-income and minority communities. Furthermore, EPA is unable to assess from the information provided in the draft PEIS whether there was an evaluation of how the proposed action and its alternatives may have unintended impacts on low-income and minority communities. Finally, EPA is concerned that the information provided in the draft PEIS may not fully reflect the conditions of minority workers in the industry.

This excerpt from Section III of the document demonstrates some of the concerns about how environmental justice issues are addressed in the draft PEIS.

> "Based on recent survey work, no low-income or minority populations appear to be significantly involved in harvesting oysters in the Bay. Historically, significant numbers of African-Americans were employed in shucking houses, but today most shuckers are immigrant Hispanic workers."

Environmental Justice refers to both minority and low-income populations. The Hispanic workers described in the draft PEIS would fall into that category, and this community should be included in any environmental justice assessment analyzing the impacts of the proposed action and its alternatives.

Because EPA has spoken to some minority oystermen over the past few years that have all painted a picture of a severely economically depressed minority oystermen population, EPA is concerned that more outreach to low-income or minority communities may be necessary to understand why these communities are no longer involved in the harvesting of oysters in the Chesapeake Bay. The minority oystermen have spoken of being forced out of the field, and the inability to participate in their chosen vocation is of serious concern to them and their families. Through appropriate outreach and community involvement on this issue, the Lead Agencies can ensure that all communities are aware of decisions regarding oyster restoration in the Chesapeake Bay

EPA suggests that additional information on minority watermen may be gained by contacting the Blacks of the Chesapeake Foundation. This organization has conducted extensive research regarding minority waterman which may be helpful; listed below is some contact information.

Blacks of the Chesapeake Foundation
P.O. Box 3576 Annapolis, MD. 21403
www.Blackschesapeake.org

Vincent O. Leggett, Founder
Vincent425@comcast.net
410.570.1187 cell
410.269.7815 office

Carnelious Jones, Chairman
Cjjones4@aol.com

Donya Maria Twyman, Executive Director
Donyamaria@virtualofficeassociatesllc.com

Appendix D Economic Analysis - The author's price projection on the demand schedule of Figure 1 in Appendix D does not show suitability for aquaculture at the historical harvest levels of 4.9 million bushels. At that harvest rate the projected price per bushel is approximately $10. At that price the aquaculture companies would be operating at a very low margin with little room for market or supply changes.

The second harvest rate mentioned in Appendix D is 2.6 million bushels. At that harvest rate, the bushel price is projected at approximately $20. The rationale of the harvest goal of 2.6 million bushels is not fully justified in the Appendix. The lowest bushel market price (as adjusted for inflation) reported by the authors was in 1974 at approximately $20. The assertion is made that this is the lowest price at which the market will operate. It is then explained that the corresponding harvest rate on the demand schedule (Figure 1) is projected at 2.6 million bushels. The authors do not give a more in-depth explanation and the readers are left to assume that the price is a result of the natural market conditions to arrive at that price. Please provide further analysis or discussion comparing the affects of harvest methods and practices and market demand factors used in the present day as compared to 1974.

In the analysis the authors utilize a "representative size" of 223 aquaculture firms producing 3,500 bushels for a total of 780,000 bushels of Suminoe oyster calculated at half shell prices. It is unclear to the reader if this figure is the maximum expected aquaculture harvest in the Chesapeake Bay. The reader is left to assume that the figure is in fact a "representative size" chosen as an example for the draft PEIS and not the total harvest of the Chesapeake Bay. Otherwise, Alternative 5 will fall short of the intended harvest rates outlined in the document. Alternative 4 has a far smaller "representative size" of 94 aquaculture firms for the Eastern oyster aquaculture analysis. In this scenario, the representative size produces 3,500 bushels yield

a total of 330,000 bushels primarily for the half shell market. In the narrative, the authors point out that Alternative 4 yields more revenue for the individual aquaculture firm when compared to Alternative 5. The authors take the position that Alternative 5 is better for the economy as there are more firms involved in production and the total revenue is more than that of Alternative 4. The authors admit that more than likely, the Suminoe oyster will be used for shucking, lower value than half shell, as it typically yields a larger size compared to the Eastern oyster. However, the authors did not use the shucking value of the Suminoe oyster in their calculations of Alternative 5.

Please provide additional information on the projected half-shell demand of nonnative oysters from the Chesapeake Bay, and further discussion of bio-security measurement costs

REFERENCES

---

[1] *Nonnative Oysters in the Chesapeake Bay – National Research Council 2004 Chapter 10.*

[2] *Oyster Advisory Panel Report Draft Programmatic Environmental Impact Statement for Oyster Restoration in Chesapeake Bay Including the Use of a Native and/or Nonnative Oyster Final Peer Review Report and Lead Agency Response.*

[3] *Nappier, Sharon P.; T.K. Graczyk; and K.J. Schwab. 2008. Bioaccumulation, Retention, and Depuration of Enteric Viruses by Crassostrea virginica and Crassostrea ariakensis Oysters. Applied and Environmental Microbiology, 74(22).*

[4] *Quantifying Threats to Imperiled Species in the United States*
David S. Wilcove; David Rothstein; Jason Dubow; Ali Phillips; Elizabeth Losos
BioScience, Vol. 48, No. 8. (Aug., 1998), pp. 607-615.

[5] *Update on the environmental and economic costs associated with alien-invasive species in the United States David Pimentel*, Rodolfo Zuniga, Doug Morrison College of Agriculture and Life Sciences, Cornell University, Ithaca, NY 14850-0901, United States*

[6] *Stein, Bruce A. and Stephanie R. Flack, eds. 1996. America's Least Wanted Alien Species, Nature Conservancy.*

[7] *Jordan, S. J. and J. M. Coakley. 2004. Long-term projections of eastern oyster populations under various management scenarios. Journal of Shellfish Research.*

[8] *US Army Corps of Engineers Norfolk District Native Oyster restoration; pers. communication.*

[9] *Nonnative Oysters in the Chesapeake Bay – National Research Council 2004 page 235.*

[10] *Chesapeake 2000 a Watershed Partnership* http://dnrweb.dnr.state.md.us/bay/res_protect/c2k/index.asp

[11] *Testimony of Denise Breitburg Senior Scientist Smithsonian Environmental Research Center before the subcommittee on Fisheries, Wildlife and Oceans Committee on Natural Resources U.S. House of Representatives September 10, 2008.*